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2012 04 26

Mr. Per Stokke
838 Somerset Avenue
Winnipeg, Manitoba
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Dear Mr. Stokke:

This letter summarizes the results of our investigation into your questions about the Pointe du Bois Spillway.

Introduction

In early 2011, you questioned the Pointe du Bois Spillway Replacement Project in correspondence with Manitoba Hydro's Ed Wojczynski. You had a discussion with our past President, Bob Brennan, and he referred the matter to the Integrity Officer (the writer) for investigation. We take your comments seriously as a retired employee and a Professional Engineer who had direct responsibilities for Pointe in the early 2000s.

Manitoba Hydro's Integrity Program encourages employees and members of the public to report any suspected cases of gross mismanagement including of public funds or a public asset. We have treated your questions as a report pursuant to the Integrity Program. In accordance with corporate policy, all program reports are investigated.

Conduct of the Investigation

This investigation was conducted by the writer (Shirley Denesiuk), Integrity Officer, with assistance from Ken Tennenhouse, General Counsel.

We reviewed your correspondence, had several phone conversations with you and had a lengthy meeting with you on January 24, 2012, to understand the nature of your concerns. We interviewed a Vice-President, a Division Manager and several employees involved in the engineering and design and involved in the corporation's Dam Safety Program. We reviewed a large volume of reports and correspondence, including all of the reports that you referred us to, and asked a number of follow-up questions of staff.

We did not attempt to conceal your identity during this investigation as you did not ask us to and, regardless, the source of this review was obvious as you have been in contact with a

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number of personnel. That said, we can assure you that the investigation focused on the issues and we did not encounter any negative reaction to you personally.

The early indication was that the issue in dispute was whether there is an engineering necessity to replace the spillway. We are not engineers and we initially discussed with you engaging an independent expert to offer insight on this issue. As it turns out, our investigation found little or no disagreement about engineering. Everyone involved agrees that, for a sufficient price, a number of existing structures at Pointe could be repaired instead of replaced. Accordingly, an independent engineering assessment was not pursued.

It was suggested that there is an established procedure for challenging the decisions of a professional engineer through the relevant professional association. You have been at pains to point out that you are simply asking questions and are not alleging any professional misconduct. We accept your input on that basis. Should you disagree with the findings of this report and wish to pursue this matter further, the association would appear to be one of your options.

The Issues

From our discussions with you we identified four principle issues and summarized them in a letter dated February 3, 2012, as follows:

1. The issue is whether the spillway at Pointe du Bois needs to be replaced at this time, or whether it could be repaired at less cost and still meet all applicable standards.
2. You point out that a 2005 study by KGS Consultants concluded that the spillway could be repaired to handle a one in one thousand year flood at a cost of \$15 — 45 million. Subsequent internal and external documents indicate that repairs would not be sufficient to meet standards. You point out that these statements are conclusions, and you have not seen any engineering evidence to support these conclusions. Your question is very simple. Where is the engineering evidence that repairs would not be sufficient? This appears to be one of the central issues, and I intend to focus my efforts on this question.
3. You point out there are problems with the 2007 Dam Safety Guidelines published by the Canadian Dam Association. Based on first impressions, these drafting problems don't appear to be the cause of any mischief at Pointe. We will be in a better position to assess that after we have answers to the central issue of why a rebuild was considered necessary.

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4. Even if the spillway at Pointe literally falls within the table in the 2007 Guidelines, you suggest there might still be ways to avoid a rebuild, based on the number of hours of notice there would be for a catastrophic flood, and based on the possibility of reducing the number of PAR's to zero by relocating persons downstream.

In a note dated February 9, 2012, you confirmed that the above letter captured the high points of our discussions, and you provided additional context and elaboration. You have provided additional context in our other discussions, including a hypothesis that the spillway rebuild is part of a long term strategy to justify rebuild of the powerhouse.

Our investigation focused on the four principle issues above together with the additional context and elaboration that you have provided.

Overview of Pointe du Bois

A chronology of decisions associated with the spillway and east gravity dam is provided later in this report. For context, it is useful to consider what was happening with the station as a whole as confirmed through our review.

Pointe du Bois is a 72 MW hydroelectric generating station on the Winnipeg River. Built in 1911, it is the oldest station in Manitoba. For most of its history Pointe was owned by the City of Winnipeg. In 2002, the Pointe and Slave Falls generating stations were transferred to Manitoba Hydro as part of the purchase of Winnipeg Hydro.

One of the City's expressed reasons for selling Winnipeg Hydro was that Manitoba Hydro is in the hydro generation business and would have greater expertise to address the deteriorated condition of the generating facilities. Major problems of all sorts at Pointe du Bois were confirmed during due diligence reviews of the transaction, and there was a recognition that replacement or major rehabilitation would be necessary.

Following acquisition, Manitoba Hydro began budgeting for a future capital expenditure for Pointe. As interim measures, Manitoba Hydro instituted safety improvements for personnel within the powerhouse, and installed concrete structures to stabilize a portion of the east gravity dam.

Studies were undertaken to identify options for Pointe, leading to a recommendation in 2005 to build a new powerhouse and decommission the old one. More detailed, Stage IV engineering studies were undertaken. These detailed studies led the corporation to conclude that the estimated cost of the project was seriously understated and that the actual cost would be much higher. The designers were asked to go back and sharpen their pencils. Attempts were made to find economies. However, the Vice-President responsible was not convinced the project could be cost justified. In 2009, work on replacing the powerhouse was suspended

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and a more limited project was approved dealing with the spillway (described in the next section below).

The assumption is that with targeted maintenance the existing powerhouse can continue to generate some amount of power for another 20 years. At that point the corporation will have to make a decision to either replace the powerhouse or decommission it. If the powerhouse is decommissioned, it is assumed that Manitoba Hydro will be required to continue to operate the dam and spillway structures for water regulatory purposes.

Issue No. 1: The issue is whether the spillway at Pointe du Bois needs to be replaced at this time, or whether it could be repaired at less cost and still meet all applicable standards.

The issue as formulated addresses the spillway but we think it is logical to also address the east and west gravity dams as part of this same discussion.

There are numerous indications that the concrete in various structures is in poor condition. For example, we were shown photos of core column samples taken from the east gravity dam. These cores should have consisted of solid concrete, but instead the photos show sand, aggregate and chunks of degraded concrete. From our discussions, our understanding is that you don't dispute these types of problems, but believe that they can be addressed through repair and rehabilitation solutions.

Our findings regarding this issue are set out below, as follows:

- a) brief discussion of the applicable standards for Pointe du Bois (further discussed under Issue No. 4 later in this report);
- b) chronological review to confirm whether repairs were considered as an alternative to spillway replacement;
- c) discussion of changes in the estimated costs to repair existing structures
- d) discussion of worker safety issues
- e) discussion of environmental issues
- f) consideration of your theory that the spillway rebuild could be intended to improve the financials for a future rebuild of the powerhouse at Pointe
- g) review of whether budget can be reduced by repair rather than replacement
- h) conclusions.

a) Applicable Standards

The principal driver of the spillway project is concern that the existing powerhouse and spillways at Pointe cannot pass enough water to meet current Guidelines.

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According to Manitoba Hydro personnel, under 2007 Guidelines published by the Canadian Dam Association, the Pointe facility should be capable of passing 5,040 cubic meters per second of water. They calculate that the facility currently is only capable of passing a maximum safe flood of 2,840 m³/s, which is equivalent to a one in 90 year flood event.

You question whether Manitoba Hydro is properly applying the Guidelines. For the purposes of organizing this report, we first address your question whether structures could be repaired instead of replaced, and then (Issue No. 4 below) we come back to your questions about the application of the Guidelines.

b) Chronological Review

The Pointe du Bois project evolved over a period of several years. Our interviews of personnel and review of the documentation suggest that there was extensive discussion of a complex mix of factors regarding the spillways among in-house and external engineering staff, with a number of site visits, inspections and studies along the way. Below, we have identified what we consider to be the most important decision points on the issue of whether to repair or replace the spillways and east gravity dam. These are not necessarily the times when senior management or the board were asked for approvals for the project, they are the points in the evolution of the engineering and project analysis that we think are most pertinent to your questions.

Following Manitoba Hydro's acquisition of Pointe in 2002, a number of inquiries and reviews were undertaken dealing with immediate safety concerns, and focused to a larger extent on the long-term solution for dealing with the powerhouse.

A report dated December 20, 2005 summarized the results of studies to that point. Options were canvassed for dealing with Pointe, including decommissioning the site, repair and rehabilitation of the existing powerhouse, spillway and other facilities (in various combinations), and replacement of the powerhouse and structures. The report concluded that Manitoba Hydro should commit to the Redevelopment option and include the necessary funds in the IFF. The Redevelopment option involved the construction of a new powerhouse, main dam and spillway at the site. The bulk of the report consists of financial comparisons of the various options. The report recommended decommissioning the existing spillway and east gravity dam but that discussion was limited.

The above report includes a lengthy analysis of the CDA Guidelines, various accepted methodologies for calculating the risk of dam failure, previous studies of that risk, and various approaches and assumptions that could be made. The report concludes that Pointe is in the CDA category "High" based largely on the calculation that approximately two fatalities could result from a failure. That finding appears to provide support for the report recommendation that a new spillway is required in order to provide the necessary discharge capacity for a

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structure in the "High" category.

All of the options in the above report included a recommendation to construct a new spillway structure. In some of the options the new spillway would replace the existing spillways, and in other options the new spillway would supplement existing structures. For example a rehabilitation option stated as follows:

"Construction of a new modern spillway structure would be included in the spillway rehabilitation for this option. This new structure would increase discharge capacity and improve operation to meet current dam safety guidelines. The required discharge capacity of the new spillway, along with capacity as required from the rehabilitated spillways, would ensure the site is capable of passing the Inflow Design Flood (IDF)"

The personnel we interviewed indicated that following the 2005 report, analysis proceeded on whether existing structures should be decommissioned or whether any could be salvaged and re-used as part of a redevelopment.

In June, 2006, a memo between in-house engineering personnel indicated that there is a need for existing spillways to be supplemented with, or replaced by, a new spillway structure. The memo reviewed four criteria for deciding whether to supplement or replace, as follows:

- the need to increase discharge capacity to meet current dam safety guidelines, and the related ability to respond to emergency conditions, especially during less than ideal weather conditions;
- the labour intensive operation of the spillway gates, and related higher risk for work related injuries;
- majority of concrete and dam structures are in fair to poor condition;
- bridge and spillway decks are too narrow to permit vehicle access.

The memo suggested that if only one or two of the four criteria were deficient it could be attractive to upgrade the existing spillway/dam structure for the long term. The memo indicated that Pointe is deficient in all four criteria and that trying to rehabilitate requires almost complete reconstruction of the majority of the existing structures, in effect building a new spillway but with additional limitations and complications inherent with rebuilding a structure. The memo concluded that new spillway/dam structures should be constructed to replace the existing structures, and that constructing the new spillway/dam at the same time as a new powerhouse is the preferred option.

In January, 2009, the corporation determined not to pursue major rehabilitation work on the west gravity dam. A report a few months earlier had found that the dam was sensitive to the loss of downstream clay fill. Among other things, the report recommended that consideration be given to the risk during spillway construction. We were told that Manitoba Hydro staff

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are not overly enthusiastic about the state of this structure, but the approach is similar to what you are recommending for some of the other structures at Pointe. i.e. the corporation is conducting regular dam safety inspections.

In June, 2009, work on replacement of the powerhouse was suspended. A more restricted project was approved in its place, as follows:

The preferred option (Option 3) for the modernization of Pointe du Bois is to replace the existing spillway with a new spillway that meets Canadian Dam Association (CDA) guidelines and to continue the operation of the existing powerhouse with maintenance to improve safety. Maintenance / upgrade initiatives at Pointe du Bois related to power production or items not associated with safety will be evaluated on a case by case basis.

As indicated in Table E1, the recommendation was made with due consideration to safety at the station, project economics / financial impact to Manitoba Hydro, and qualitative considerations. The qualitative considerations included risk to the environment / regulatory process, benefits to southern system reliability, and impact to the upcoming NFAT (Need for and Alternative To) process for Keeyask and Conawapa. Option 3 was either beneficial or adequate in regard to all the factors considered in the table. In no instance was the option considered detrimental to a particular consideration.

The primary need to modernize Pointe du Bois stems from the inability of the existing structure to meet Canadian Dam Association guidelines for spillway capacity, concerns related to deterioration of the aging facility and operation of aging equipment in a safe manner. Improved reliability and increased station capacity of Pointe du Bois was not a driver for modernization of the station, however, the benefits of the potential increased reliability or capacity were noted in the economic analysis of options.

Personnel have told us that following the above decision, the designers were challenged to justify all expenditures at Pointe and to identify the bare minimum required to meet safety requirements. They told us that options involving repair / rehabilitation of existing structures were put back on the table. In other words, at that point the corporation was questioning the project in much the same way as you are doing today.

Personnel told us that for a short time during 2009/10, the repair option was actually the leading option for dealing with spillway bays 45 – 65 and the east gravity dam. We found support for that view in our review of the documentation, including further engineering reviews of what would be necessary to rehabilitate these structures to meet the 2007 Guidelines. These reviews suggest that repair options were considered viable right up to the point when replacement was decided. KGS did find that repairs to bays 45 – 65 would not address operational concerns such as ice loading and the need to de-ice spillway gates in an emergency. It also found that work during the transition period was likely to be “more

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intricate than originally envisioned when the concept was developed to utilize Bays 45 to 65”.

In May, 2010, a draft KGS report concluded that the cost saving to repair bays 45 to 65 instead of replacing was minimal (\$3 million). At meetings in May and September, 2010, Manitoba Hydro made the decision to proceed with replacement of these spillway bays based on the minimal cost premium and substantial additional benefits including the longer lifespan of fresh concrete and resolution of operational / worker safety concerns.

A decision to replace the east gravity dam was made in December, 2010. The total budget for a new South Dam complex (which includes replacement of the east dam) including indirects is \$24 million. The designers considered 3 options for replacement of the east gravity dam, at direct costs of between \$12.2 and 14 million, and an option of installing anchor structures to stabilize the existing dam for \$1 million. This dam was stabilized with anchor structures in 2002 as an interim measure, and in 2010 none of those involved had any confidence in the integrity of the anchor structures that had been installed. The \$1 million fix was projected to have a life of 20 years and was expected to be just be one of the expenditures required as further deficiencies came to light. A replacement structure was projected to last indefinitely (50 -100 years). Determining factors supporting the replacement option included the continuing receipt of core samples indicating deteriorated concrete in this structure and the risk of destabilization during blasting operations for a new spillway.

We were able to verify that the blasting issue was under active study at the time and note a December, 2010, draft report prepared by KGS which comments that: “The greatest concern will be for the closer structures as the blast vibration dissipates with distance. However, there remains a level of risk to all the existing concrete structures, including the EGD [*east gravity dam*], during the construction blasting and stability measures should be evaluated for each.”

We are told that an option that would reduce the budget of the South dam complex is currently under consideration, however, as that remains uncertain we base our review on the decisions that have been made to date.

c) Changes in Estimated Cost to Repair

You pointed out to us low estimates of the cost to repair the existing spillway provided by SNC and KGS during the period 2002- 2004.

We have reviewed and confirm that your observations are accurate.

In speaking with design personnel, they don't take issue with the engineering in these reports, but they do take issue with the cost estimates. They have advised that these studies were conceptual in nature. For example, SNC estimates are included in a report which also advocated for a technology involving rubberized dams.

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They say that a new effort to accurately identify the costs of the project was undertaken in 2009, following suspension of work on the powerhouse. These reviews identified significant costs of the project that had not been considered in conceptual studies, such as mobilization of the workforce, staging of the work, ensuring sufficient discharge capacity through the site during the construction period, access during construction, minimizing impacts on sturgeon habitat, etc. Earlier studies also ignored significant "indirect" costs, and environmental approvals and licensing. They advise that accurate cost estimates were only possible after detailed Stage IV engineering. They also indicate that two "peer review" processes were also initiated, in which respected personnel from the industry and from other parts of the corporation were brought in to critique and probe the designers' assumptions.

Personnel indicate that when the options for spillway bays 45 – 65 were properly costed out and compared on an even basis, the cost of repair was close to the cost of replacement (but with lesser benefit). We find support for that assertion in a draft KGS report dated May 14, 2010, which identified the following: "*\$3.0M premium over modified original concept*".

d) Worker Safety Issues

In our investigation, it became clear that concerns about employee safety were a material factor in the decision-making. A 2002 report prepared by SNC Lavalin noted safety issues associated with narrow access pathways across the tops of dams and dykes. We were told that Pointe has an unusually large number of spillway gates, 91 of which must be operated manually. To open each gate, a crew of men must manually push a gantry crane over narrow pathways and dyke structures, for distances that can be lengthy. They must then pull up the gate from a position at the top of the deck. We were also told that unlike the other stations in Manitoba Hydro's system, the gates at Pointe lack heating mechanisms and have a tendency to ice up in winter. Work crews must carry out de-icing procedures in awkward conditions to deal with gates that have frozen shut. District management responsible for carrying out this work consider that Pointe has the most primitive working conditions in the Manitoba Hydro system. We have no difficulty accepting that some of the current workplace conditions at this century-old site are archaic.

You have suggested that these types of issues could be addressed through repair of existing structures. We find that design personnel did consider methods of addressing some of these repairs such as improved access, as part of the 2009/10 review discussed above, and that this was one of the contributing factors to increased cost estimates for the repair options. We also find plausible management's conclusion that employee safety would be better accommodated by new structures designed to contemporary expectations.

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e) Environment Issues

In our discussions with design personnel, we were advised of a major current issue with federal fisheries officials involving lake sturgeon. It is evident that the sturgeon issue has had a significant influence on the design of the project at Point. We were told (and have no reason to doubt) that considerations of sturgeon habitat have impacted on fundamental decisions such as the locations of the principle structures.

The documentation suggests that a number of additional factors were considered in the design of the project, such as the impact on other environment and regulatory processes. We did not attempt to verify all of these statements. Based on the sturgeon issue, we are prepared to accept that design decisions involved a complex mix of considerations.

f) Financial Review

In addition to reviewing the chronology and specific issues, as a further check we undertook an exercise to break down the Pointe project into a series of component parts. We reviewed each component from the perspective whether the budget could be reduced by repairing instead of replacing.

The total approved cost of the project is \$398 million plus interest and escalation. At our request, Power Supply provided a rough breakdown. We use percentages of the total budget below because to use dollar amounts would imply more precision in these numbers than actually exists, this was just an exercise. Our conclusions are as follows:

Construction of New Primary Spillway (52% of budget): A new spillway to supplement or replace the existing spillways has been planned since 2005 because the existing structures cannot pass sufficient water to meet CDA Guidelines. The condition of the existing structures is not the issue.

New Secondary Spillway to replace existing spillways (26% of budget): Repair of existing spillway units 1 - 44 is not an acceptable option because the river bed is too shallow at this point and a channel will have to be excavated to pass sufficient water. In May, 2010, KGS concluded that the cost to repair existing units 45 - 65 was within \$3 million of the cost to replace. Replacement has greater benefits.

East / West Dam / River Management (15% of budget): This work involves removal of an existing rockfill dam to make way for additional spillway. The issue whether to repair or replace has no application to this component of the work.

South Dam to replace the east gravity dam (7% of budget): In December, 2010, the corporation concluded that replacement of this dam was preferable to a short-term fix, based

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on the ongoing deterioration of the concrete, longer lifespan of a new structure and concerns about stability of the structure during the construction period.

West Gravity Dam (negligible % of budget): In 2009, the corporation concluded that this structure can be retained through stabilization measures with a regular safety inspection program.

g) Future Powerhouse Rebuild

In our discussions you advanced a theory that the real reason the Spillway is being replaced is to improve the financial analysis for a future rebuild of the powerhouse at Pointe. For convenience we call this the Future Powerhouse Rebuild Theory ("FPR Theory"). The personnel we interviewed indicate that this is not how the project is being approached. They indicate that the project is being designed to accommodate current Guidelines and either of two long term future scenarios, a rebuilt powerhouse, or a decommissioned powerhouse and continued operation of Pointe as a regulatory facility. Existing structures cannot pass sufficient water in any of these circumstances.

Staff have no great confidence the powerhouse will actually be rebuilt in future. Given the failure of the extensive effort to justify a new powerhouse during 2007-09, it is uncertain whether a future rebuild of the powerhouse can be justified. We noted a November, 2009, report prepared by the corporation on the implications of decommissioning, and comments in a December, 2011, KGS report that: "There is some uncertainty at this time as to the continued long-term operation of the Powerhouse; it is possible that it may be decommissioned at some point in the future".

To investigate the FPR Theory further we reviewed the documents, particularly for the key decision points identified earlier in this report.

The December, 2005, study report discussed an option of pre-building a spillway that could be used as part of a Rehabilitation option and with a Generating Station constructed at a later date. This was viewed as useful to mitigate deficient spillway capacity. However, the report suggested this could increase the cost of long term options and recommended further study to better assess the costs. These comments appear to be inconsistent with an FPR Theory.

During the June, 2006, discussion of whether existing structures should be repaired (see above), four factors were considered, not including the future financials of the powerhouse. At that point in time, a powerhouse replacement was likely a given.

There is no relevant discussion in the 2009 decision to suspend powerhouse work. The preferred option selected in October, 2010, was replacement of the spillway, followed in 2030 by rebuild of the powerhouse. The rationale for selecting this option was summarized in a

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table that listed the factors considered. Included on the list were items such as dam safety, staff safety, energy from 2018 to 2030, capital cost and other financials, environment, and other factors. The financials for a future rebuild of the powerhouse were not one of the criteria included on the evaluation table.

In summary, we could not find support for an FPR Theory.

h) Conclusion: Issue No. 1

In our discussions, you expressed concern that Manitoba Hydro may have drifted into a decision to replace the spillway. That is not what our investigation disclosed. The decision to build a new spillway was supported by what appears to be a thorough 2005 study analysis and concerns over the current discharge capacity of the structure which can only deal with a one in 90 year flood. The personnel we interviewed describe a lengthy process to decide on whether to repair or replace existing structures at site based on analysis, site inspections and detailed discussion amongst in-house and external engineering staff. Plans for these structures were made and refined a number of times as the engineering analysis unfolded and as the designers were challenged to find economies. Decisions to proceed with replacement of the secondary spillways and east gravity dam were made in 2010 following a review of costs and options.

You also expressed concern that the decision may have been based on a false assumption that the existing structures have to be replaced for engineering reasons and that they cannot be repaired. That is not what we found. Options involving repair of existing structures were actively considered at several points. We reviewed numerous in-house and external reports that reviewed the feasibility of repairs to the spillways and east gravity dams, continuing right up to 2010 when replacement was finally decided. Although we did see reports on the continuing deterioration of concrete structures, we did not find evidence that these problems were being exaggerated. For a time during 2009/10, repairs were actually being considered as the leading option.

Issue No. 2: You point out that a 2005 study by KGS Consultants concluded that the spillway could be repaired to handle a one in one thousand year flood at a cost of \$15 — 45 million. Subsequent internal and external documents indicate that repairs would not be sufficient to meet standards. You point out that these statements are conclusions, and you have not seen any engineering evidence to support these conclusions. Your question is very simple. Where is the engineering evidence that repairs would not be sufficient? This appears to be one of the central issues, and I intend to focus my efforts on this question.

As described in the earlier sections of this report, based on our review the engineering was never in dispute. Everyone involved agrees that, for a sufficient price, a number of the

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structures at Pointe could be repaired instead of replaced. Design personnel do take issue with early, conceptual level estimates of the costs of repair.

You point out there are problems with the 2007 Dam Safety Guidelines published by the Canadian Dam Association. Based on first impressions, these drafting problems don't appear to be the cause of any mischief at Pointe. We will be in a better position to assess that after we have answers to the central issue of why a rebuild was considered necessary.

In our discussions you pointed out that in the 2007 Guidelines, a dam is classified in the "High" category if the risk of loss of life in a hypothetical failure is greater than zero and less than 10, and "Very High" if the risk is greater than zero and less than 100. i.e. a dam with a very minimal risk could be classed as either "High" or "Very High". We agree that this is poorly drafted. As noted below, Manitoba Hydro calculated that Pointe du Bois is the "High" category based on an estimated loss of life of between 1 and 10 persons, not based on any technicality in the wording. In other words, our investigation tended to confirm that drafting problems in the Guideline were not consequential in the context of Pointe.

You also suggested that the Guidelines allow, or ought to allow, greater discretion on the part of a utility in the case of existing structures that do not generate new revenue. We cannot find a substantial level of discretion based on our read of the 2007 Guidelines. The Manitoba Hydro personnel we spoke with are not convinced this is a drafting error, they believe it reflects a value judgement on the part of the Canadian Dam Association.

You pointed out that Winnipeg Hydro avoided substantial investments in Pointe. We were referred to a 1996 study commissioned for Winnipeg Hydro which found that the discharge capacity of the plant would only withstand a one in 60 year flood. As a result of modest work initiated by Winnipeg and completed by Manitoba Hydro, the discharge capacity was increased to withstand a one in 90 year event. That still does not meet standards. We have no information on the City of Winnipeg's rationale for that.

You pointed out that the Guidelines are not legally binding on Manitoba Hydro. That may be only temporary. The CDA website indicates that the Province of Manitoba is considering a regulation. In Alberta, guidelines were published in the form of a regulation pursuant to *The Water Act* in March, 1999. British Columbia included guidelines in a regulation, last amended in 2011. Ontario published an August, 2011, technical bulletin to provide direction to Ministry staff responsible for application reviews. Personnel also advised that a new water power license is required for Pointe and that it will be necessary to demonstrate the protection of public safety as part of relicensing. It is further believed that if an incident were to occur, national Guidelines would be a consideration in any civil suit alleging negligence, or in a prosecution alleging criminal negligence. We accept that it would be reckless to ignore the Guidelines.

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Should you wish to pursue the drafting issues further, one of your options would be to contact the Canadian Dam Association.

Issue No. 4: Even if the spillway at Pointe literally falls within the table in the 2007 Guidelines, you suggest there might still be ways to avoid a rebuild, based on the number of hours of notice there would be for a catastrophic flood, and based on the possibility of reducing the number of PAR's to zero by relocating persons downstream.

The Pointe project is largely driven by the conclusion that the structure must be capable of passing 5,040 m³/s of water in order to meet national Guidelines. Under the Guidelines, when the number of persons at risk of loss of life ("LOL") is greater than zero and less than ten, a dam is classified as a "High" risk, and it must meet an Inflow Design Criteria that is 1/3 of the way between a 1:1,000 year flood and the Probable Maximum Flood. We are told that the 1:1,000 year flood at Pointe is 4,280 m³/s, and the Probable Maximum Flood is 6,570 m³/s.

We were able to verify the above approach in our review of the Guidelines and various study reports, and were able to calculate the number 5,040 using simple arithmetic.

When we spoke with you we were using the terminology "number of persons at risk" (the "PAR"), but following our review we have concluded that the key issue is actually the LOL. The PAR is one of the factors from which the LOL is derived. We believe you are correct that if the LOL was near zero, 5,040 could be considered overly conservative and the planned scope of the project would be wasteful. On the other hand, the reasoning of Manitoba Hydro's designers appears to be sound if the LOL is one or greater.

Manitoba Hydro received a number of external consultant estimates of LOL at Pointe. In 2001, KGS predicted LOL of 1.5 persons. In 2002, Acres predicted LOL of between 3 and 5 persons (with an upper range of 17). In 2002, SNC Lavalin estimated LOL to be below one in all cases which they rounded to one, and under particular assumptions near zero (0.066).

The divergent numbers above are the result of placing more or less weight on factors such as the number of people in the area, the number who might be on or off site at the time of a disaster, the amount of prior warning, etc. All of these factors are quantified, and different results are achieved based on the assumptions that are chosen. For example, one study assumes that a percentage of the people at risk would be away from site during the day, at work or at school.

The project is planned on the basis of an estimated LOL of approximately 2 persons, based on the KGS estimate of 1.5. In the December 20, 2005, report, Manitoba Hydro's calculation of LOL is canvassed in a lengthy discussion that considered the various methodologies and different assumptions that could be made. The report estimated loss of life of up to 8 persons in a conservative scenario stated to be unrealistic, and as little as zero in a "Sunny Day"

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scenario which assumes that the dam failure occurs in a favorable way, plenty of advance warning, the ability to warn all affected residents, etc.

As admitted non-experts in this area, we would find it somewhat difficult to accept that a dam failure in a built up area such as Pointe du Bois has a risk of zero fatalities. We were shown maps that identify 46 houses and cottages directly downstream of the dam within the limits of a 1:1000 inundation, and there are many more in close proximity to the 1:1000 limits. Manitoba Hydro personnel reviewed scenarios with us where there would be time to warn residents of an impending flood, but we also reviewed plausible scenarios where there would not. e.g. water flow through the powerhouse is interrupted as a result of mechanical breakdown. A full area evacuation has never actually been attempted. The reality is that no-one can predict exactly what would happen and where local residents, children and visitors might be on the day of a failure.

You have suggested that the houses and cottages could be relocated a few feet uphill, and in this way achieve LOL of zero. We assume that you have a valid technical basis for that approach. However, the relocation of all houses and cottages can be considered an aggressive assumption. There is no evidence that Winnipeg Hydro or Manitoba Hydro have ever made any effort to relocate anyone at Pointe, and we question whether it would actually happen. The relocation of persons and facilities to make way for Manitoba Hydro requirements tends to be the subject of considerable public controversy and pushback. Again, as admitted non-experts in this area, we would find it somewhat disconcerting that there is a zero risk in a built up area.

Thankfully, it is not necessary for us to decide the "correct" LOL, assuming that is possible to do. Our review suggests there can be more than one supportable opinions.

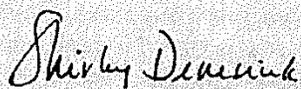
The dam safety personnel we interviewed exhibited no outward signs of bias. They appear to have the right qualifications, appear to be fully conversant with the subject matter and were enthusiastic in discussing their work with us. We note that the assumed LOL of 2 is "Middle of the Road", greater than the Sunny Day estimate of 0 but lower than the more conservative estimate of 3-5 generated by Acres. They indicated to us that they arrived at their conclusions based on their judgement of the risk of fatality in the event of a failure at Pointe taking into account all the circumstances. They did not treat the LOL calculation simply as a mathematical calculation; they expressed what appeared to be genuine concern that Pointe du Bois poses a substantial risk to public safety. We are not prepared to second-guess their professional judgement.

Mr. Per Stokke

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There are currently significant cost pressures on Manitoba Hydro and we would have welcomed an opportunity to identify economies in the Pointe du Bois project. Based on our review, we cannot find a basis for doing so. None the less, your questions were reasonable ones and deserving of review.

Yours truly,



SD/slw